

IMPACT OF THE FOOD AVAILABILITY, NESTING-HABITAT DESTRUCTION AND CULTURAL VARIATIONS OF HUMAN SETTLEMENTS ON THE NESTING DISTRIBUTION OF A COASTAL BIRD, *EGRETTA GULARIS*, IN WESTERN INDIA¹

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(With seven plates & five text-figures)

The nesting distribution and location of nineteen nesting colonies of the reef heron, *Egretta gularis*, in the Gujarat State of India, are described. The numerous bays, estuaries and swamps in Gulf of Kachchh and extensive tidal mudflats in Gulf of Khambhat are highly favoured by the herons for feeding. Much of the rocky and sandy coast of the western and southern Saurashtra is not favoured by the herons, but, they occur wherever there are tidal creeks and estuaries. In Gulf of Kachchh, the mangrove swamps still exist on numerous tidal islands, and the bird breeds there rather than on the mainland. Elsewhere on the shores, the mangroves are degraded or eliminated so that the bird breeds in the trees on dry land in human settlements. The coastal human communities predate on birds, so that the safe nesting trees are fewer in small coastal villages and towns. In large cities where a majority of the people protect the nesting birds, there are many safe trees for nesting. Where there is no coastal city around a rich feeding ground, the bird turns inland where a cropland, or a city, may provide ample safe nesting sites.

INTRODUCTION

At one time, the mangrove forests on the coast of Gujarat State provided the tree-nesting coastal birds a natural site for nesting. The large scale destruction to the extent of virtual extirpation at times, of mangroves for cattle fodder, firewood and timber during the present century, resulted in an important loss of the nesting habitat, so that the coastal birds have taken to nesting on trees in human settlements (Parasharya and Naik 1983). The cultural environment of a human settlement that determines whether it would be safe for

the birds to nest there, varies regionally; this has added another dimension to the factors determining locations of the colonies of tree-nesting birds in the region. The present paper illustrates an interplay between an important nesting requirement, proximity of the feeding area, with the other nesting requirement, safety of the nesting site ensured or denied by the human settlements, in determining the nesting distribution of a colonial tree-nesting bird, the Indian Reef Heron, also called Western Reef Heron, *Egretta gularis* on the coast of Gujarat, India.

The reef heron is found on the coasts of West Africa and Red Sea and western coasts of the Indian Ocean (Ripley 1982). The heron, which is polymorphic with respect to its plum-

¹ Dedicated to Dr. Sálím Ali on the occasion of his 88th birthday. Accepted November 1984.

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age colour ranging from dark grey to pure white (Naik and Parasharya 1983) and occurs in the coastal regions, is ecologically separated from its pure white close relative the Little Egret, *Egretta garzetta*, which occurs inland. The nesting distribution of the reef heron is poorly known (see, Naik *et al.*, for a review, 1981) and it was thought that the bird "possibly migrates locally to special areas" to breed (Ali and Ripley 1968). This paper, therefore, also represents a first serious attempt to study the nesting habitat preference and distribution of the reef heron in a part of its range in India.

MATERIALS AND METHODS

Gujarat State, where the present studies were conducted, is divided for geographical and historical reasons into Gujarat, Saurashtra and Kachchh (Kutch) regions; the Gujarat region is further divided into northern, central and southern parts (Fig. 1).

Several representative coastal areas of Saurashtra and South Gujarat (Fig. 1) were surveyed during the heron's breeding season from March to September (see, Naik *et al.* 1981) mainly during 1980 to 1983. Wherever we found a nesting colony, we visited that area more than once in most cases and thoroughly surveyed a large area around the nesting colony. The nesting trees, number of nesting pairs, extent of nest predation and feeding habitats of the nesting birds were observed and recorded. We made observations on the proportion of different morphs of herons at the nesting colonies and nearby feeding grounds, and also on the breeding behaviour and feeding techniques, but, we hope to present those observations elsewhere.

We have had the occasion to re-visit some of the study areas outside the heron's breeding season as well, and we took these opportunities to look for the bird's roosting sites.

OBSERVATIONS

Gulf of Kachchh and northern coast of Saurashtra

Gulf of Kachchh bounded by Kachchh on the north, Saurashtra on the south and Little Rann (Desert) on the east, opens in the Arabian sea (Fig. 1). The gulf has an average depth of 30 m and an irregular coastal configuration with a number of islands, creeks and bays (Shrivastava and John 1977). Many tidal islands close to the gulf coast are covered with mangroves, and the reef heron is a common bird here throughout the year.

We have not looked for the heronries on northern coast of the gulf, but Ali (1954) has recorded a breeding colony on a tidal island in Kandla creek, near Kandla. We visited several places on the southern coast, namely, Jodia, Jamnagar, Sikka (16 km northwest of Jamnagar) and Okha (Fig. 1) and areas of the mainland around these places, but, failed to find any nesting colony of the heron. This was so, despite the fact that we have seen a large number of reef herons feeding in the coastal estuaries and inland waters in the non-breeding season. On the other hand, we have received several authentic reports of the herons breeding on some of the islands such as, Chusna and Sona Miya (Lavkumar, Personal Observations) near Okha in the Gulf. Pirotan is one such island where the birds are reported to be nesting. We could not visit this island during the peak period of breeding, but visited it from 8 to 10 March just about the time nesting started in 1980. Our several other visits to the island were made in the winter.

Pirotan is a tidal island which is connected by a land bridge to the Pirotan swamp and Saurashtra coast during the low tides (Fig. 2); the Pirotan swamp supports mangroves in various stages of degradation. On the northern side of the island, there is a lighthouse and

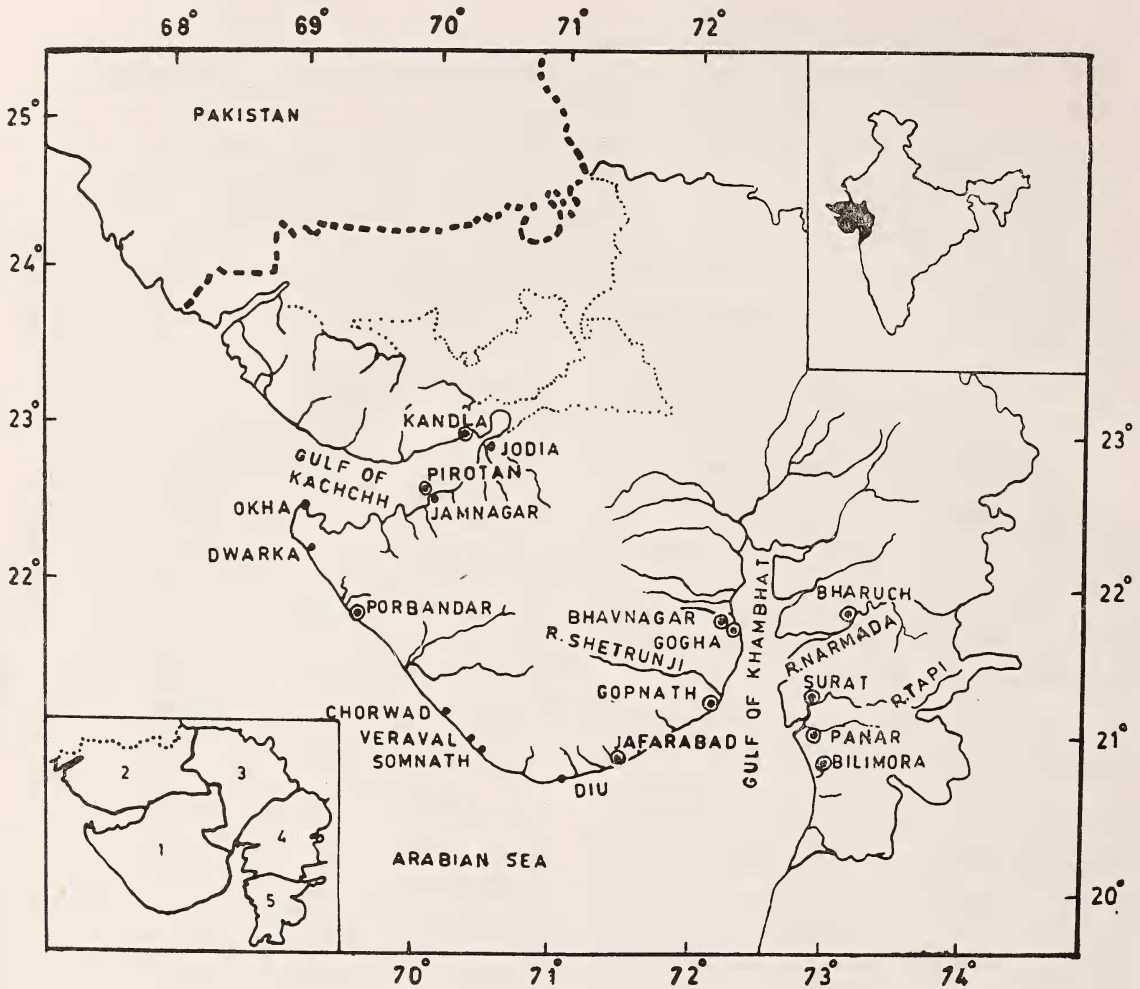


Fig. 1. A map of the Gujarat State locating the places (solid circles) referred to in the text. The locations where the reef herons are found nesting are encircle by open circle. The inset on the upper right shows location of the Gujarat State within India. The inset on the lower left shows a divisions of the Gujarat State into Saurashtra (1), Kuchchh (2) and Gujarat regions, and a further divisions of the Gujarat region into northern (3), Central (4) and southern (5) parts.

a few buildings housing the lighthouse staff and on the southeastern side a small mangrove swamp (Plate 1a). The extensive intertidal zone around the island has silty and/or sandy substratum interspersed on the northern side by reefs of live and dead corals. A large population of the reef heron roosts in and around

mangroves on the island along with the Grey Heron (*Ardea cinerea*) and Great White or Large Egret (*A. alba*). During our visit in March, we observed the reef heron as well as the Grey Heron in courtship display, on the mangroves and recorded that a few of them had their facial skin in the nuptial colour

(crimson). We could only reach up to a few nests of the Grey Herons on the periphery of the swamp; it was difficult to move on soft silty floor of the swamp without causing serious disturbance to the birds.

Summarizing the above, the reef herons of Gulf of Kachchh breed on various islands where a natural nesting-habitat is still available and do not seem to do so on the mainland.

Southern coast of Saurashtra

The Saurashtra coast from Okha to Diu (Fig. 1) has a relatively narrow intertidal zone which is mainly sandy and/or rocky. In this sector, we visited Dwarka, Chorwad, Porbandar, Veraval and Somnath and found that the heron on the coast proper is relatively less common in the breeding as well as non-breeding seasons. We have been told that many years ago there was a reef heron colony on mangroves in a riverine estuary of Miyani Creek, near Harsad Mata, north of Porbandar (Lavkumar, Personal Communication). One of us (R.M.N.) visited this place on 7 April 1984, and found that only a few patches of mangroves had managed to survive in the creek and they supported a small colony of the Large Egrets and reef herons. We did not find any heronry in Chorwad, Veraval and Somnath. We, however, found it in Porbandar city, a part of which has grown around the tidal estuaries and creeks.

One, or both, of us visited Porbandar on 18 March 1981 and 3 July 1982. The herons nested here in thickly populated parts of the city and most of the nesting trees were within a kilometer of the feeding places which were the mudflats and tidal pools in the creeks and estuaries (Plate 1b). The nesting trees, chiefly Neem (*Azadirachta indica*), Peepal (*Ficus religiosa*), Banyan (*Ficus benghalensis*) and Casuarina (*Casuarina equisetifolia*), were in the compounds of Rupadiba Hospital (Plate

1c). General Hospital, Court House and Darbar Gadh (Palace) as well as on the sides of Mahatma Gandhi Road. We saw the herons nesting exclusively in March and with the Cattle Egrets (*Bubulcus ibis*), White Ibis (*Threskiornis aethiopica*) and Black Ibis (*Pseudibis papillosa*) in July; this is attributed to the fact, earlier recorded by Naik *et al.* (1981), that the reef heron starts nesting earlier than the other Ciconiiform birds.

From Diu to the Gopnath point (Fig. 1), there are low overhanging cliffs on the coast and the shore is rocky, sandy and muddy. On this stretch of coast the reef heron occurs, but, it is rather sparse. Here, the herons were found nesting in the Jafarabad city in 1982 by Mr. P. C. Malli (Personal Communication). The birds have been nesting in the city for a long time, as they were also observed nesting there about 35 years ago by Mr. B. B. Vaidya (Personal Communication).

In Summary, on the southern coast of Saurashtra which has a shoreline without many bays or creeks and a narrow rocky and/or sandy intertidal zone, the reef heron is sparse or rare. However, wherever there are tidal creeks and estuaries with extensive mudflats, the reef heron occurs commonly and may breed in the nearby cities, exception being a small number of the reef herons nesting on mangroves in the Miyani Creek.

Gulf of Khambhat

Coastline of the gulf of Khambhat (Cambay) extends from Gopnath in Saurashtra to the mouth of Tapi (Tapti) river in south Gujarat. Several rivers from the eastern Saurashtra and central and south Gujarat, including two major rivers Narmada and Tapi, open in the gulf. The silt brought by these rivers has made the gulf rather shallow and muddy. The gulf coast has a gentle slope so that an extensive intertidal zone, which is mainly muddy, is

exposed during the low tide (Figs. 3 to 5). Here as in Gulf of Kachch the reef heron is a common bird. For a study of the bird's nesting distribution, we surveyed a small area immediately north of the Gopnath point, Bhavnagar-Gogha area, Bharuch (Broach) city and the banks of Tapi river from Surat to the sea coast.

Both, or one, of us visited the Gopnath area on 8 February and 19 March of 1980, 26 March and 15 May of 1981 and 26 March of 1983, and found four nesting colonies, one each at Gopnath, Gadhula, Khandhera and Pithalpur (Fig. 3).

In a grove of Banyan and Peeper (*Ficus amplissima*) close to a 15th century Gopnath (Shiva) temple, some reef heron pairs were nesting. Two kilometres north of the temple there is Gadhula village (population of 2000 people, who are mainly farm labourers and fishermen) right on the sea coast. The reef herons were nesting in a grove of tall Peepuls and Banyans around a temple of Goddess Kali within the village (Plate 2f). We also saw a Black Ibis and Indian Whitebacked Vulture (*Gyps bengalensis*) pair nesting and a number of Night Herons (*Nycticorax nycticorax*) roosting in the same grove of trees. Plate 2 sharply contrasts a thick growth of trees of the sacred grove (f) with those in the rest of the village (d & e); the trees outside the sacred grove are widely scattered and many of their branches are lopped off.

The other two colonies in the Gopnath area were in the croplands close to the Khandhera and Pithalpur villages. The Khandhera colony of about 30 nests on a Peeper tree is close to a tidal creek, about 2 km away from the coast and about 11 km north of Gopnath. The Pithalpur colony also located in an agricultural farm (Plate 3, g & f) was the biggest colony in this area. The farm, where the colony

was located, comprised of a farm house, couple of barns and a cropfield and had about 250 coconut trees (*Cocos nucifera*) planted on its border. The crown of 50 to 60 among the tallest coconut trees here were used by 112 to 133 pairs of herons in different years. There were some young Peeper and Banyan trees on the farm, but these were not used by the herons for nesting. The farmer told us that they first nested in the farm in 1978, and since then they have been nesting every year. During one of our visits in winter we found that many reef herons were roosting on the same coconut trees. Because of the birds' nesting and roosting activities, there was considerable loss of flowers and young coconuts. The coconuts were also damaged by the birds' excreta dropping on them; we saw that the birds' excreta had dripped down the surface of most of the coconut fruits (Plate 3h). The farm owner estimated that he lost about 50% of his coconut crop every year because of the herons. Despite the heavy loss of income, the farmer and his family tolerated the herons and did not molest them in any way. The herons and their broods on top of the tall coconut trees, were almost free from predation. The Cattle Egrets, White Ibis, House Crow (*Corvus splendens*), Jungle Crow (*C. macrorhynchos*), Common Myna (*Acridotheres tristis*) and Rosy Pastor (*Sturnus roseus*) came to roost in the farm, and the Cattle Egrets even nested there. The nesting reef herons readily came down on the ground to collect nesting materials close to the barns and farm house. However, they did not feed on the farm, or anywhere nearby, but flew about 5 km to the sea coast to feed.

In the Gogha-Bhavnagar area (Fig. 4) we found three heron colonies, one each at the Gogha town, New Port of Bhavnagar and Bhavnagar city, within a distance of about

NESTING DISTRIBUTION OF EGRETTA GULARIS IN W. INDIA

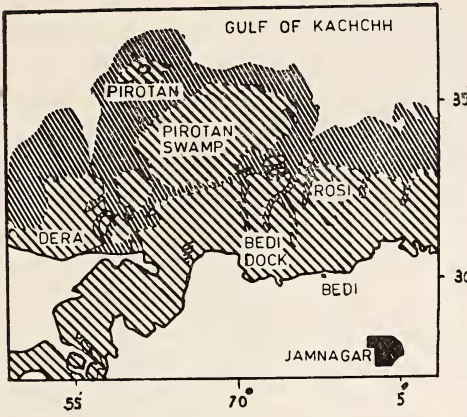


Fig. 2.

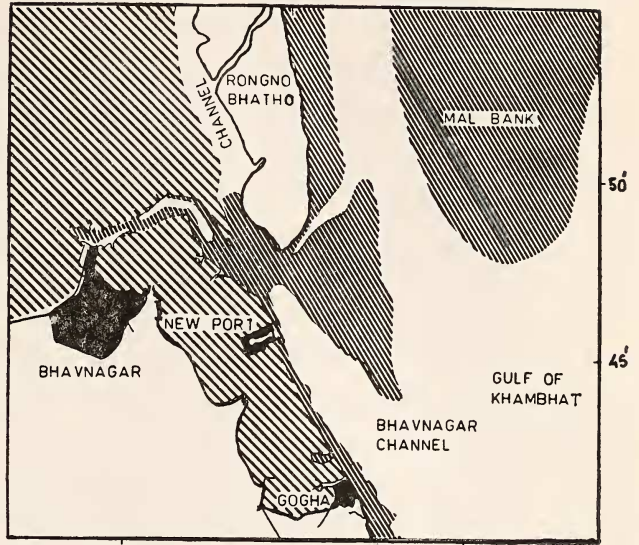


Fig. 4.

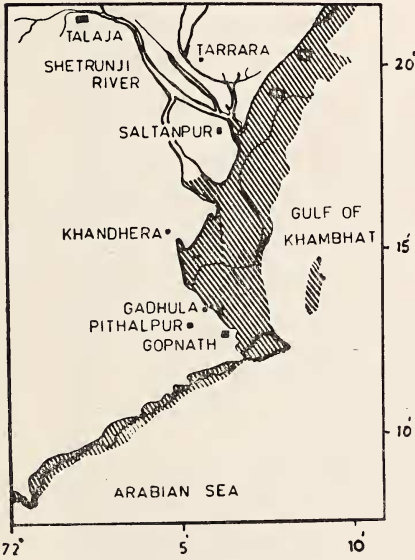


Fig. 3.

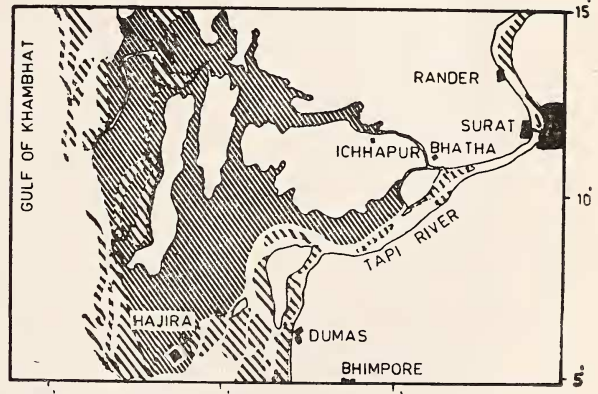


Fig. 5.

Figs. 2 to 5. Maps showing the extent of intertidal zone near some of the heronry sites, namely, Pirotan island (Fig. 2), Gopnath, Gadhula, Khandhera and Pithalpur (Fig. 3), Gogha, New Port and Bhavnagar (Fig. 4), and Surat and Bhimpore (Fig. 5). The intertidal zone is marked with thin closely spaced lines and the areas partially covered only during the spring tide is hatched with thick widely spaced lines. The rural and urban areas are shown in solid black.

20 km. Because we had selected these areas for the intensive studies of the reef heron to be published elsewhere, we visited them fre-

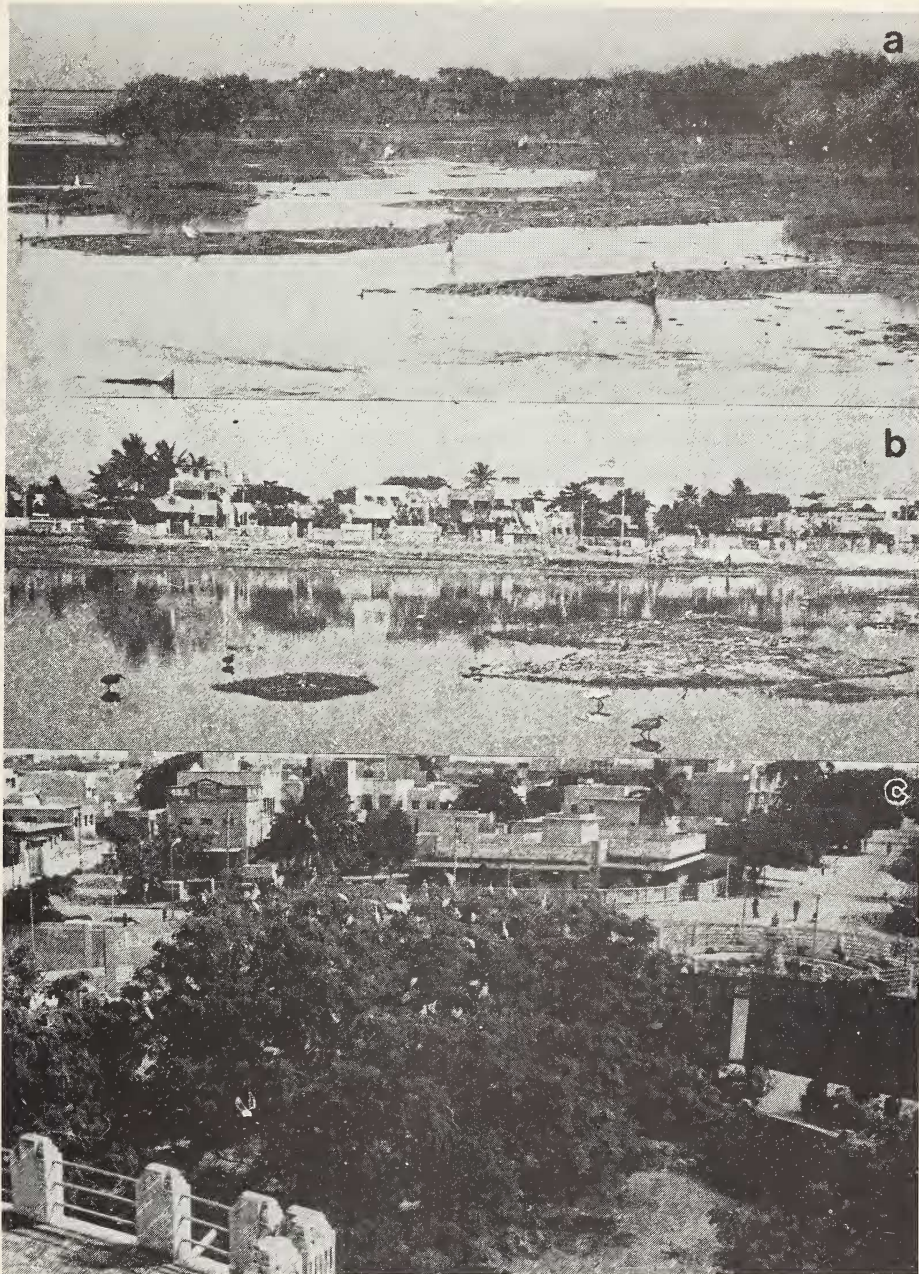
quently in all seasons throughout the study period.

The Gogha colony is located in a coastal

town of Gogha with a population of about 7000 people, a majority of them belonging to fishing and seafaring communities. The colony had been described earlier by Naik *et al.* (1981). The majority of herons here nest in a grove of young Neem, Peeper and Peepul (Plate 4 j&k) within a quadrangle surrounded by the barrack-type buildings housing the Mamlatdar's office, small jail and residential quarters of the constabulary. The Pond Heron (*Ardeola grayii*), Night Heron, Spoon-bill (*Platalea leucorodia*) and Painted Stork (*Mycteria leucocephala*) also nested with the reef herons on an old tamarind tree (Plate 4 i) growing at the edge of the premises. Some of the herons also nested on a few huge Tamarind (*Tamarindus indica*) and Peepul growing on the roadside within the town. The birds nesting within the quadrangle of the Mamlatdar's office premises were largely protected against human interference, but those nesting in the town often lost their eggs and chicks because of the predation and interference by the town boys. The nesting trees were used by the reef herons for roosting throughout the year. Within less than half a kilometre flying distance from the colony, the extensive mudflats on the sea shore exposed during the low tides and the tidal creeks, were the feeding grounds of the herons. During the high tides, the herons often visited the nearby fresh water ponds to feed and rest.

The New Port colony where we found the biggest concentration of the nesting reef herons, is located in the port area which is fenced around and human entry to it is severely restricted. The area includes docks, warehouses, administrative and office buildings (but, no residential quarters). The birds nested on Peepul, Peeper, Tamarind, Casuarina, Mesquites (*Prosopis juliflora*) and Portia trees (*Thespesia populnea*) growing on the road-sides close to administrative and office build-

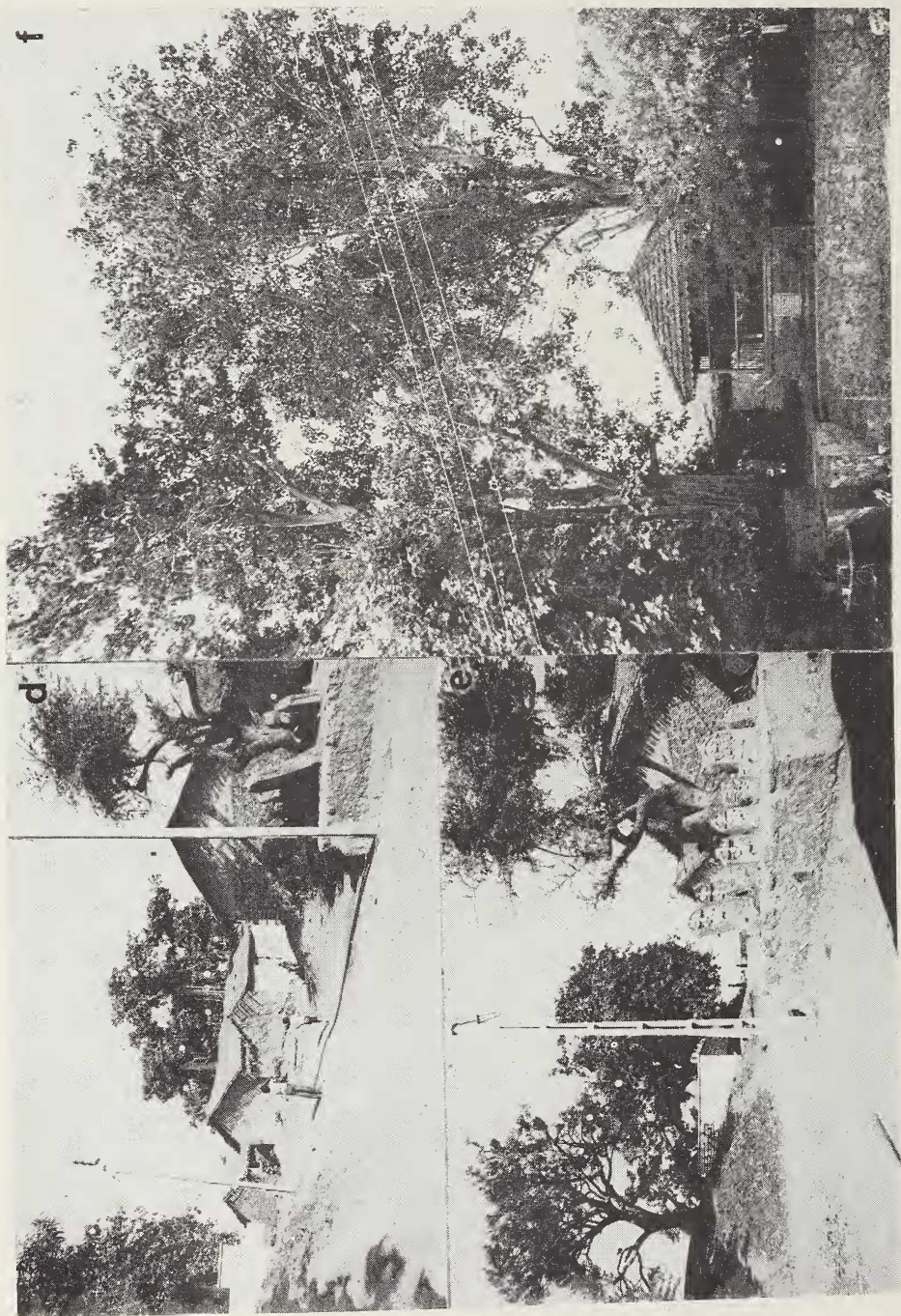
ings and warehouses, (Plate 5 l&m), within an area of about half a square kilometre. Out of the 70 to 80 nesting trees, a majority were the Portia trees which were short and stunted, none of them being more than 6 m high. A few heron pairs also nested on mangroves (*Avicennia* sp.) close to the seaward side of the port. Though most of the heron's nests were low and the port area was buzzing with activities during certain hours, the herons remained apparently undisturbed, so that they were relatively easy to watch and photograph (Plate 6 n&o). The birds would readily come down from the nesting tree to the ground to pick up nest material. They were actively protected by the dock workers and no one would dare to molest them. The dock workers had even nursed a large number of herons that were stunned by shock and cold during the cyclone which hit Saurashtra in November 1982. Occasional predation of the heron's eggs and chicks by the domestic cat and the House Crow occurred; a few House Crow pairs even nested in the port area from May to July. Among the Pond Heron and White Ibis which nested with the reef heron, the White Ibis was a serious competitor of the heron for the nesting sites. The ibis came into breeding condition later than the herons and occupied the heron nests after ejecting the nest contents. The ibis, however, preferred to nest on top of the tall trees, so that the heron nests built lower in the same trees, and also those on short trees, were not affected. Another reason for the success of the New Port colony is that the nesting birds had rich and extensive feeding grounds available close to the colony. During the low tide, the mudflats except the channel dredged for an approach of ships to dock, became exposed almost up to the horizon, and birds avidly fed on the mudskippers and other fishes from the mudflats and tidal pools. When the coast was covered with water, the herons often visit-



Feeding and nesting sites of the reef heron. (a) A part of the Pirotan island and adjoining intertidal zone. (b) A tidal creek near Chhaya plot, Porbandar. (c) A nesting tree of the cattle egret and reef heron in a hospital compound, Porbandar.

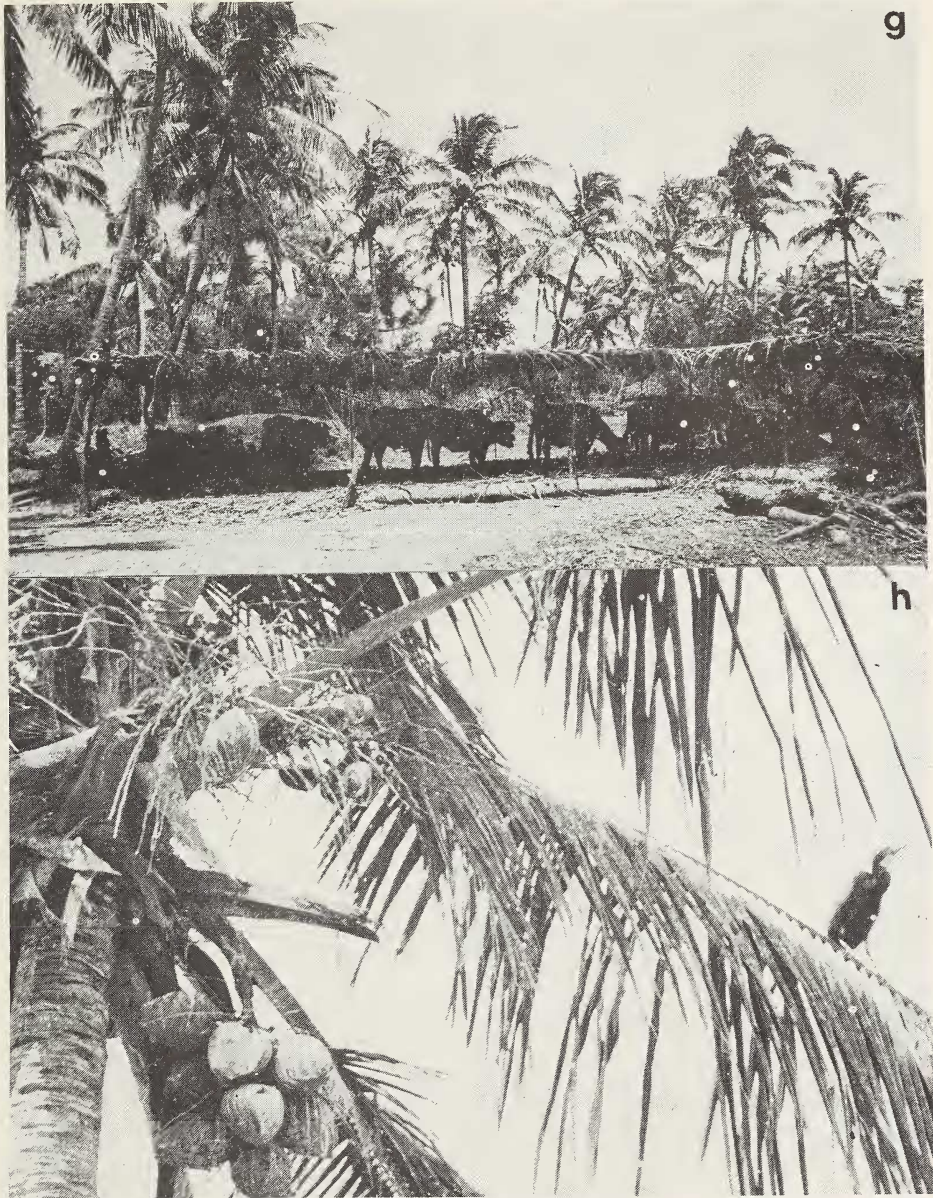
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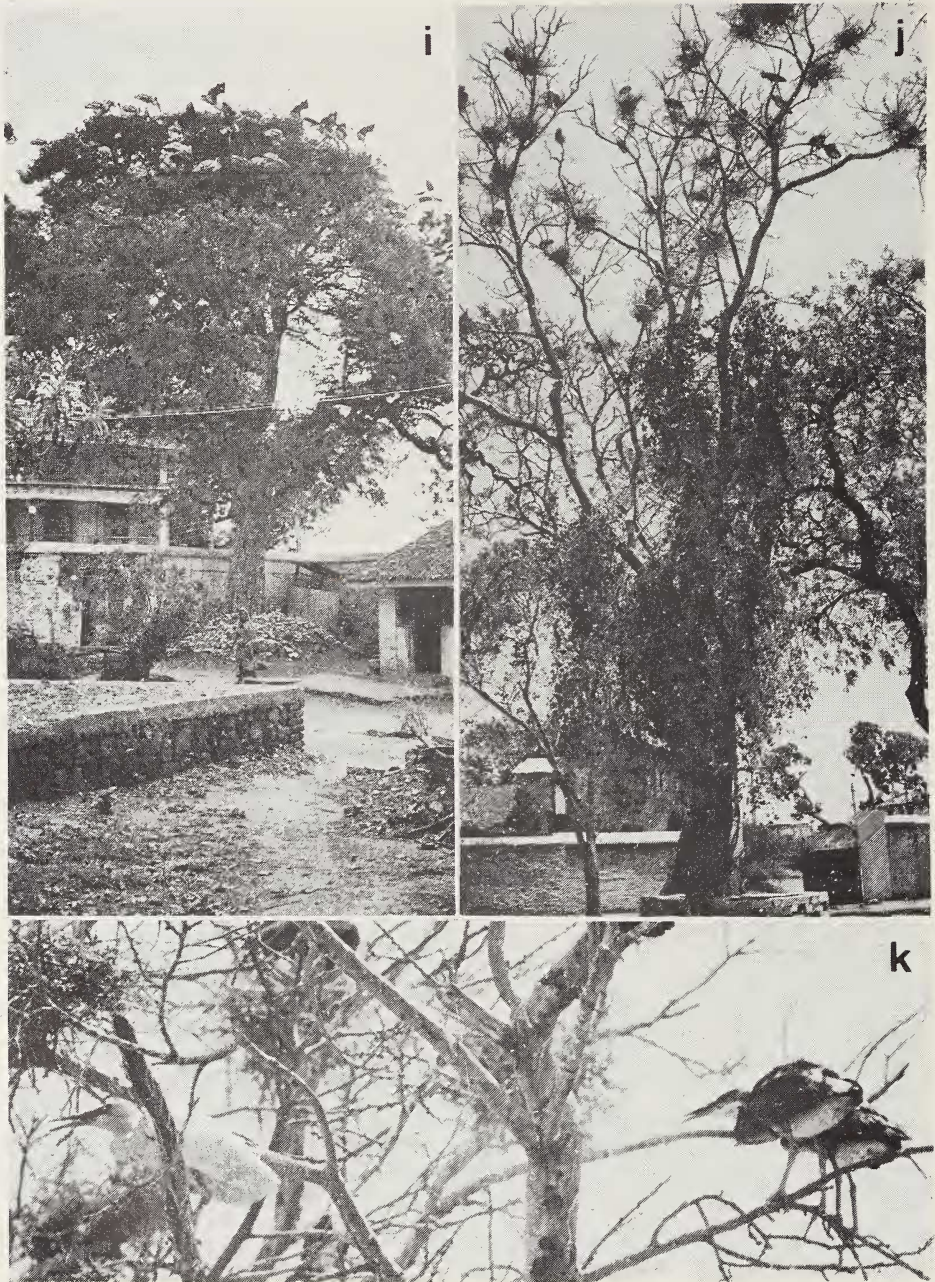
(d & e) General views of the Gadhula village. (f) Nesting trees of the reef herons in a sacred grove in Gadhula.

(Photos: Author)



(g) Nesting trees of the reef heron in a Pithalpur farm. (h) A close-up view of the Coconut fruits smeared with the herons' droppings.

(Photos: Author)



The Gogha heronry in the Mamlatdar Office compound. (i) A Tamarind tree used for nesting by the painted stork and reef heron. (j) A Peepul with the reef heron nests. (k) Two grey phase nestlings (right) and a white phase adult (left) on a nesting tree.

(Photos: Author)